Alaska Department of Fish and Game
Division of Wildlife Conservation
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Physiological Ecology of Moose: Nutritional Requirements for Reproduction with Respect to Body Threshold Conditions

Kris Hundertmark

Research Performance Report
1 July 2001–30 June 2002
Federal Aid in Wildlife Restoration
Grant W-27-5, Project 1.52

This is a progress report on continuing research. Information may be refined at a later date.

FEDERAL AID
ANNUAL RESEARCH PERFORMANCE REPORT

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 25526
Juneau, AK 99802-5526

PROJECT TITLE: Physiological ecology of moose: Nutritional requirements for reproduction with respect to body condition thresholds

PRINCIPAL INVESTIGATOR: Kris Hundertmark

COOPERATORS: Kenai National Wildlife Refuge

FEDERAL AID GRANT PROGRAM: Wildlife Restoration

GRANT AND SEGMENT NR.: W-27-5

PROJECT NR.: 1.52

WORK LOCATION: Kenai Moose Research Center, Soldotna

STATE: Alaska

PERIOD: 1 July 2001 – 30 June 2002

I. PROGRESS ON PROJECT OBJECTIVES

OBJECTIVE 1: Determine overwinter nutritional requirements for reproductive success in female moose.

We formulated multiple rations to simulate natural diets with varying levels of energy and protein. Using a controlled access feeding system, we applied nutritional treatments to cow moose and quantified changes in body composition throughout the year.

OBJECTIVE 2: Determine thresholds in body condition at which reproductive performance declines.

Using ultrasonography, we diagnosed pregnancy status and calf viability in cow moose exposed to various nutritional treatments.

OBJECTIVE 3: Evaluate the existence of cumulative effects in female moose relative to body condition, reproductive performance and nutrition.

Using a repeated measures design, we quantified moose body condition, litter sizes, and calf mass as well as metabolizable energy intake.

OBJECTIVE 4: Refine estimation of moose body composition using ultrasonography.

We continue to refine ultrasonographic measures of fat and muscle thickness for quantifying energy and protein reserves. In addition, a new cutaneous palpation scoring method shows promise for quantifying body fat in very lean animals.

OBJECTIVE 5: Using ultrasonography and a quantitative serum assay, develop and refine methodology for diagnosing twinning in moose.

OBJECTIVE 6: Evaluate effects of density dependence on body condition, reproductive performance and diet quality of moose on natural browse.

Captive and free-ranging moose were examined to quantify the role of habitat quality and animal density on nutritional condition.

II. SUMMARY OF WORK COMPLETED ON JOBS IDENTIFIED IN ANNUAL PLAN THIS PERIOD

JOB 1: Feeding trials and moose handling

No work was completed for this job during this period.

JOB 2: Capture neonatal calves

No work was completed for this job during this period.

JOB 3: Validate approaches for determining body fat and body protein in live moose.

Carcasses and live moose were used in the evaluation of ultrasonography and a cutaneous palpation scoring method for improving estimates of body fat in lean animals.

JOB 5: Density effects

Foraging moose were observed within each of three square mile pens to determine how intake parameters (bite size, bite rate, intake rate) and plant nutritional quality (dry matter and protein digestibility) vary among browse-induced architectural plant morphologies of principle winter browse species. Forage nutritional quality did not significantly change in response to previous browsing. Dry matter digestibility averaged 49%, 44%, and 48% and protein digestibility (based on nitrogen and tannin content) averaged 2.4%, 1.5%, and 0.2%, in aspen, birch, and willow, respectively. The protein digestibility estimates were lower than the estimated 6% minimum requirement needed to maintain positive nitrogen balance and suggest moose may be nitrogen limited during winter. Average bite size (grams/bite) decreased while bite rate (bites/min) increased in plants that sustained previous browsing; therefore intake rates (grams/minute) did not differ among architectures. However, because plants that had sustained browsing during previous years offered significantly less biomass, moose spent more time traveling among plants within browsed patches (123% as much time) to obtain comparable intake of that within unbrowsed patches. Therefore, intake maximization depended on biomass distribution not only within, but more importantly, among plants.

Through collaboration with Mark McClure and Lisa Shipley of Washington State University we propose to analyze movement pathways of moose using fractal analysis. Over the past winter, frequent GPS locations were obtained with Televilt GPS collars fitted on 2 moose (1 per treatment) and with a handheld Trimble GPS carried by an observer while recording intake. In doing so, we hope to identify the scale-dependent properties of moose movements in both space and time. This endeavor is important because it should help us identify the scale(s) exerting influence on moose foraging, which, in turn, will provide a starting point for linking fine-scale foraging behaviors to expected patterns of animal distribution at landscape scales. This endeavor is also important because it will allow us to more effectively model the effects of heterogeneity on the foraging behavior of herbivores.

In addition, we measured moose body fat in relation to pen treatment and winter severity (i.e., snow depth). Treatment was either a pen in an early or late successional stage. Mean rump fat depths of moose moved from the late to early successional treatment increased 0.33cm (6.23% ingesta-free body fat) from the previous year. Conversely, moose moved from the early to late successional treatment declined 0.23cm (6.08% ingesta-free body fat).

Free-ranging moose in three populations in the state of Alaska (Denali NP, McGrath area, Yakutat Forelands) were handled during collaborative projects. We measured body fat in relation to lactation status, in utero fetal numbers, habitat quality (diet composition), and winter severity. We purchased a small, lightweight ultrasound unit to support our statewide efforts to examine body condition and reproductive parameters. Data collected during this period are part of long term investigations and results will be forthcoming.

III. ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE THAT WAS ACCOMPLISHED ON THIS PROJECT DURING THIS SEGMENT PERIOD

IV. PUBLICATIONS

Jenkins, S.G., S.T. Partridge, T.R. Stephenson, S.D. Farley, and C.T. Robbins. 2001. Nitrogen and carbon isotope fractionation between mothers, neonates, and nursing offspring. Oecologia 129:336-341.

Jenkins, S.G., T.R. Stephenson, J.A. Crouse, D.E. Spalinger, and C.T. Robbins. Effects of plant architecture and chemistry on moose (*Alces alces*) browsing behavior. Canadian Journal of Zoology. In Review.

V. RECOMMENDATIONS FOR THIS PROJECT

Prepare final report.

VI. APPENDIX

VII. PROJECT COSTS FOR THIS SEGMENT PERIOD

FEDERAL AID SHARE $ 54,992 + STATE SHARE $ 18,331 = TOTAL $73,323

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APPROVAL DATE: _____